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NEW PROCESS

FOR THE

CULTURE OF THE VINE

BY

PERSOZ,

PROFESSOR TO THE FACULTY OF SCIENCES OF STRASBOURG; DIRECTING PROFESSOR OF THE
SCHOOL OF PHARMACY OF THE SAME CITY.

TRANSLATED BY

J. O'C. BARCLAY,

SURGEON U. S. N

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DEDICATORY.

TO NICHOLAS LONGWORTH, Esq.,

Whose intelligent efforts and great perseverance have done so much toward establishing, upon a firm basis, the culture of the vine, and the art of winemaking in the United States, is dedicated this version of Professor Persoz's monograph upon the Culture of the Vine. In making this offering to one, who is known wherever on the hillsides of the clear Ohio the vine gladdens the vintager, the translator feels assured that, through him, it will speedily reach the hands for which it is principally intended—the hands of the practical cultivator. Guided by the admirable instruction therein contained—offspring of science and experiment—the rural population of our Middle States, invoking Ceres and Bacchus, may plant the alleys of their smiling vineyards with the golden corn, and in due season gather in the double reward of their toil.

Many a rock on which now the wild rose scarcely finds sufficiency of nutriment, may, under the hand of him who, unblessed with hoarded capital, still rejoices in the capital of thews and sinews, start into luxuriant vegetation; and thus plots of barren mountain side, attainable even by indigence, may prove sources of support, perhaps of ease, to many who now subsist upon the wages paid by an employer.

In dedicating this work to you, the translator in some measure makes you responsible for its circulation, and should this circulation, in any degree, advance the knowledge of the culture of the vine, in which, with yourself, he feels a deep interest, he will deem himself fully remunerated for the labor and expense of the undertaking.

TRANSLATOR'S PREFACE.

THE subject treated of in the following pages is one which has taken a strong hold upon the mind of the American public, and as the interest manifested in it has grown with the rapidity which characterizes every undertaking in which the genius of our people embarks, we have thought that the labor of a few hours could not be better bestowed than in bringing before our agricultural masses the philosophical system proposed and pursued by Prof. Persoz.

This system, suggested by the laws of agricultural chemistry to an intelligent mind, has been boldly carried on in consonance with those laws, and, illustrated by happy experiment, has resulted in a method, admirable for its clearness, neatness, and economy of labor and space. The cultivator of the vine, no longer groping in the dark, no longer trusting to traditionary and empirical usages, may now begin with a reasonable prospect of witnessing a successful issue to his toil. Unembarrassed by peculiarities of soil, almost indifferent, indeed, whether there be soil, he plants the precious wine-giving shrub in an artificial bed, containing all the elements necessary to the growth of the woody fibre, through which are to be elaborated the juices of the fruit; and having witnessed this growth advancing with a celerity not generally exhibited by nature in the temperate zones, curiously watches for the moment when its full development points out that the energies of the roots (one office being fulfilled), may advantageously be diverted from the fabrication of cellulose to the crowning effort—fructification. The rich compost which has covered his trellises with branch, tendril, and leaf, is now superseded by another, equally efficacious in its line, and, instead of beholding the shooting forth of a luxuriant growth of wood, doomed to be severed by the pruner's knife, he sees the swelling clusters of the grape, bending the parent stem with their luscious burden.

By this new method more than half of the labor ordinarily devoted to the culture of the vine is rendered unnecessary, and at least one-half of the soil may be tilled and appropriated to the production of culinary or other vegetables, or even to some of the cereals, no injury thereby resulting to the vine.

The experiments of Prof. Persoz having been conducted upon no very extended scale, afforded him no opportunity of testing the vinous quality of the grape; but since the very elements indicated by nature, are offered to the plant, and are assimilated by it, there should be no reasonable doubt that the excellence of the fruit for vinification will prove to correspond with the healthfulness of the vine. Rich manures, as is well known, have always been avoided by the wise cultivator, whose desire is to produce a full-flavored, saccharine grape; and in certain localities of France, the municipal authority has interfered to prevent the use of such gross stimulants, which, while they produce abundant wood and large crops of fruit, impart something of their rankness to the juice.

In Prof. Persoz's method of culture, none of the grossness of the initial manures can be communicated to the grape; for it is not until these manures have fulfilled their office that the plant is called upon for fructification, and the stimulants then applied are inodorous and destitute of sapidity. Such being the case, no adventitious and offensive flavor will, in all probability, be associated with the juices of the fruit, and we may safely calculate on obtaining just such a crop as the particular vine selected would give, under the most favorable circumstances of soil and culture. The temperature and exposure (upon which temperature in part depends), have much to do with the perfecting of the fruit, and these should be carefully studied. Drainage and irrigation are rendered so easy by this method, that this alone would induce many to follow the system of trenching here laid down.

In conclusion, we would remark that nowhere, as in this work, have we seen the culture of the vine set forth in terms so clear, and so utterly free from empirical notions; and we cannot but wish that every one whose revenue depends upon the result of the vintage, may carefully study and faithfully pursue the excellent advice here offered.

JNO. O'C. BARCLAY,

Surgeon, U. S. Navy, Philadelphia.

PREFACE.

THE new method of culture which we propose—permitting, for the production of alimentary plants, the utilization of half of the soil devoted to the culture of the vine—may seem, at first, completely to deviate from the divers modes, brought into use in our times, in the various viticultural regions. In order, however, to allay the fears of cultivators, we lose no time in stating that this is not the case. In fact, we do not pretend, either to offer a new system of pruning—since that which we propose has received the sanction of a long experience—or of giving as novel the development of our vines on trellises—though the form of that which we present offers some peculiarities—since in Italy, in the south of France, in certain of the Rhenish provinces, methods are followed which, in a greater or less degree, approximate to the regular disposition which we describe; or of modifying the manner of removing buds and of tying the vine.

That by which our process is distinguished from all others, consists in this: that we collect all the vine stocks of a certain superficies of soil in a single trench, in which, by an initial chemical action, we stimulate, in the first place, the growth of the wood, and then, by a second action, the development of the fruit. We have arrived at this result by establishing, through direct experiment, that in the manures adapted to the culture of the vine, there are materials, some of which serve exclusively for the increase of the cellular tissue, that is to say of the wood, others for the development of the germ—fruit or grape—and that the action of these substances, instead of being simultaneous, should be successive. By the application of these principles, we arrest at will the growth of the wood, which, in the ordinary processes, is regulated only after artificial and empirical means.

PLATE I.

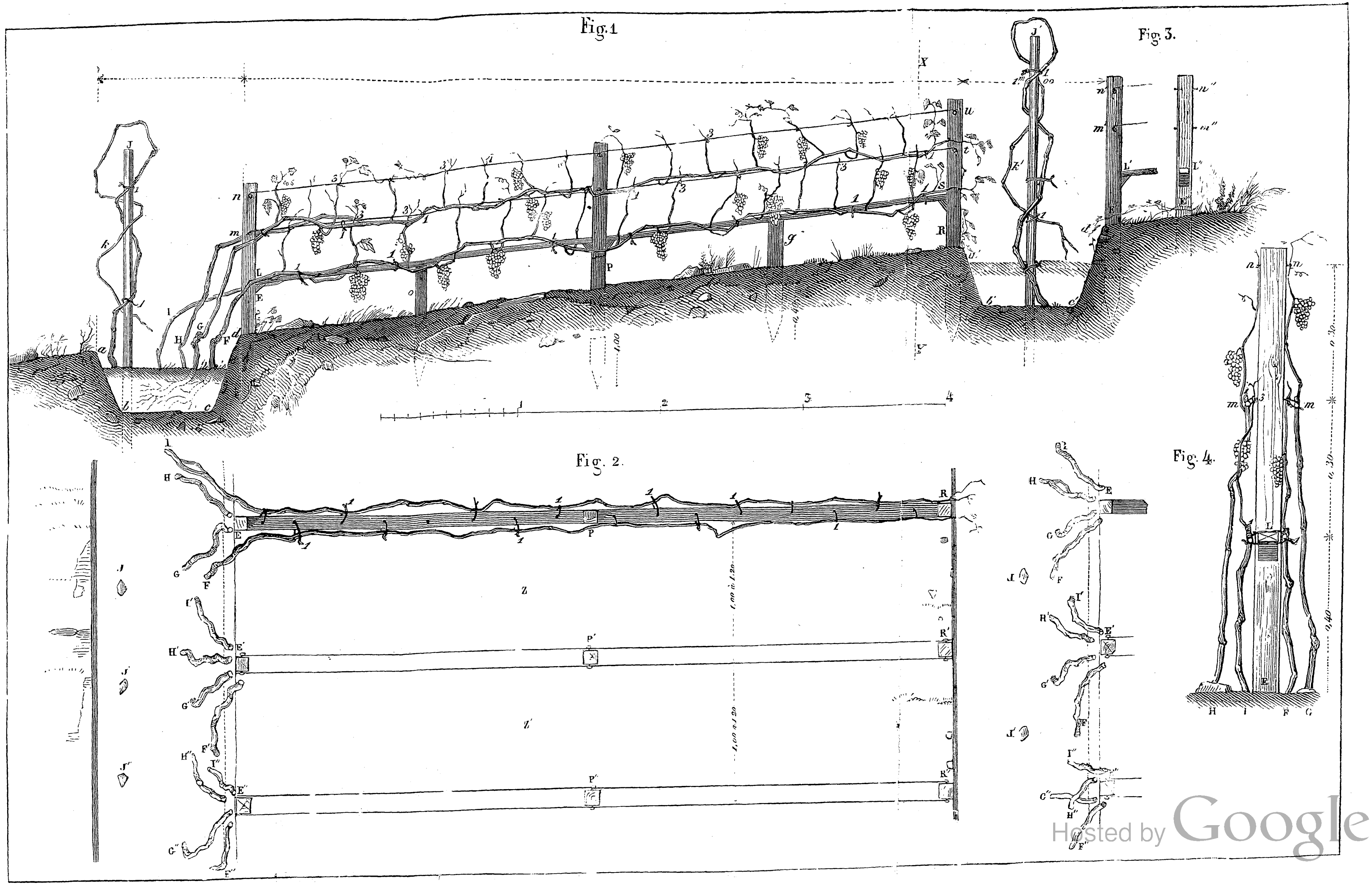
Fig. 1
Fig. 2
Fig. 3
Fig. 4
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PLATE II.

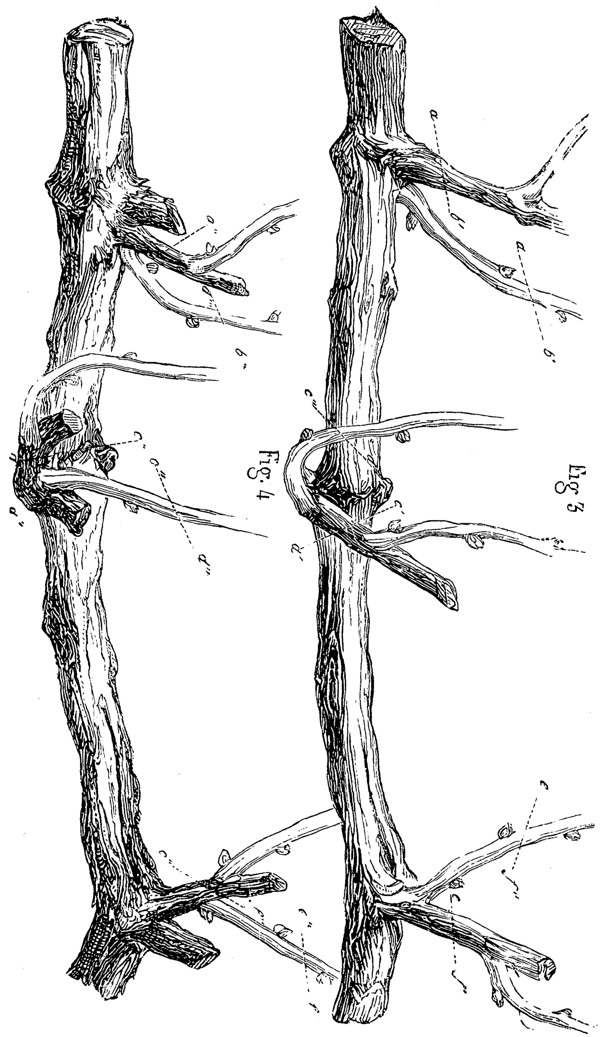


Fig. 1.

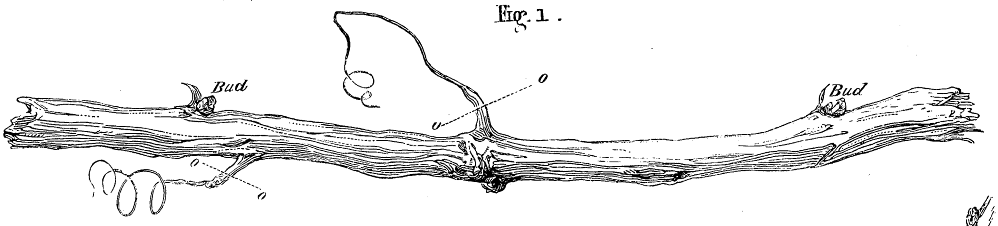
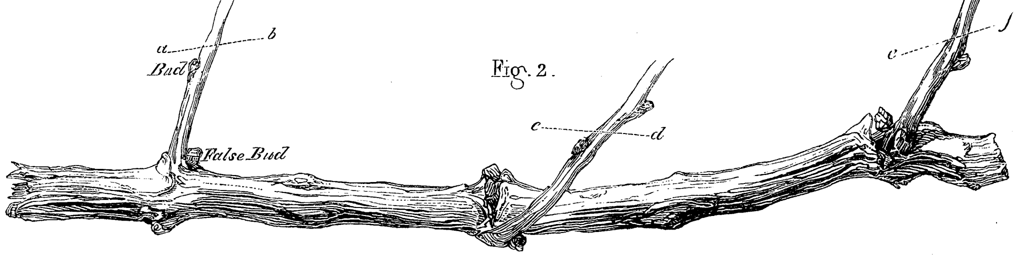


Fig. 2.



EXPLANATION OF PLATES.

PLATE I.

FIGURE I.—Elevation of a trellis seen in a longitudinal direction.

$a\ a'$—earth line,

$a\ b\ c\ d$—first trench or ditch.

$a'\ b'\ c'\ d'$—second trench or ditch.

$E\ P\ R$—$E'\ P'\ R'$—$E''\ P''\ R''$—Posts two yards and six inches in length, by two and three-fourths to four inches of a side, buried one yard and three inches in the earth ; on these posts are stretched the iron wires.

$L\ S$—Slats of two and three fourths to four inches in width by one inch in thickness, pierced with holes at intervals, for the passage of *osier ties*, 1 1 1, destined to fix the canes of the lower stage of the trellis. These slats are supported, viz., at their extremities by the aid of small pegs or brackets attached to the posts $E\ P\ R$ at their middle, by means of the stakes $o\ g$.

o g—Stakes two feet four inches in length by two inches of a side, buried fourteen inches in the earth and sustaining the slats *L S*, which are fastened by a nail—*m t*—*n u*, iron wires stretched on each side of the posts.

1 1 1—Osier ties serving to attach the vines to the slats *L S*, of the first stage, and to the iron wires *m t* of the second.

3 3 3—Straw ties, by aid of which the young shoots are fastened to the wires of the second and third stages.

k k'—Reserved vine stocks.

J J' J''—Props or Supports.

F G H I—F' G' H' I'—F'' G'' H'' I''—Vine stocks laid down in the trench.

FIGURE 2.—Plan of three trellises.

z z—Soil susceptible of being devoted to the culture of alimentary plants.

Figure 3.—Commencement of trellis with side view of a post.

Figure 4.—Cross section of trellis on a larger scale.

PLATE II.

Figure 1.—Wood of first year's growth.

Figure 2.—Second year with *first pruning*, *a b ; c d ; e f.*

PLATE III.

Figure 3.—Third year with *second pruning*, $a'\ b'$; $a''\ b''$; $c'\ d'$; $c''\ d''$; $e'\ f'$; $e''\ f''$.

Figure 4.—Fourth year with *third pruning*, $a''\ b''$; $a'''\ b'''$; $c''\ d''$; $c'''\ d'''$; $e''\ f''$; $e'''\ f'''$.

NEW PROCESS

FOR THE

Cultivation of the Vine.

CULTURE OF THE VINE.

THEORETICAL PART.

While giving attention to some ornamental plants, we were led, several years ago, to the employment of preparations or artificial manures, destined to multiply the number of the flowers, and to augment the brilliancy of their tints: the results then attained, suggested to us the idea of undertaking essays in a more utilitarian view, in other words, for the promotion of agriculture.

It was with the vine that we exclusively occupied ourselves; first, because the small plot of ground which we had at our disposition did not permit us to try the same experiments upon other plants; in the second place, because, initiated from childhood into this particular culture, we were better able to examine into it, and to compare issues. In 1846 we made known to the Academy the results to which we had been led by the parallel culture of two vine stocks, of which one had been treated with phosphates, the other abandoned to itself. The first, which showed an extremely vigorous vegetation—we gave at the time the measures of the shoots, in diameter and length—was loaded with grapes; the other, on the contrary, was without fruit. Since that time the stock subjected to the influence of the phosphates, has never failed annually to be covered with grapes; all the fruit-bearing branches or shoots of the year, the largest of which did not exceed in length and thickness the dimensions of a swan's quill, and the middling sized ones those of a goose quill, have always borne, at the least, two bunches, often five, commonly three, and all the fruit would bear comparison with the best Chasselas.

Finally, to complete this first experiment, during the last spring we subjected a normal stock, which, never having received artificial manuring, had never presented more than a few bunches, to the same treatment with that to which it served as a term of comparison, and it was, this autumn, covered with fruit to such an extent as to excite the astonishment, not only of those who have followed our comparative experi ments, but also of those who were called upon to judge of it for the first time.

The principle which directed us at the commencement of our researches, is very simple. No wine exists which does not contain tartar, or what the chemist denominates bitartrate of potassa: if then the plant is required to form tartaric acid, it is indispensable that it should be furnished with the potassa necessary. Now, to give to the vine the potassa of which it stands in need, the potassic salt must be chosen in such a state that the roots may assimilate it without inconvenience to the plant; and, moreover, the epoch at which it is proper to offer it to them must be determined. After having, in the aforementioned note, signified the state in which the salt of potassa should be administered, we had still to determine what influence would be exerted on vegetation by the ammoniacal salts, or by the nitrates, and to indicate the moment when it would be proper to cause the potassic salt to act. To this end we devoted ourselves to numerous experiments, which were facilitated by the obliging kindness of Mr. Michelle, formerly rector, who placed at our disposition a portion of the garden at the Academy, of which he enjoyed the use.

To discover the veritable agents in vegetation, we caused the germination and vegetation of maize, common beans, peas, barley, spring wheat, kidney-beans, and two species of cabbage, in twenty-six different media; but, in opposition to that which has generally been done, up to the present time, instead of taking any soil at hazard, as the starting point of our experiments, which always leaves some uncertainty hovering over the direct or indirect part played by the substance tried, we adopted, as the basis of our operations, pure silica—the white sand of the glass blowers—and in pots of the capacity of about three quarts, some of them filled with pure sand, others with sand, to which was added, either pure phosphate of lime—this same phosphate mingled with carbon or other organic matter—or silicate of potassa, pure or mixed with phosphate of lime, all the phenomena of vegetation were accomplished; the circumstances were in other respects the same, since these vessels had the same exposure, and were irrigated with water, the nature of which was known to us.

From these various experiments, the details of which will be published in proper time and place, has resulted the proof that for all the aforementioned plants, the kidney bean excepted, the phosphate of lime, and the silicate of potassa—soluble glass—are the eminently active agents of vegetation. No comparison can be drawn between the products, not only of the pure sand, but likewise of this sand mingled with substances, until now marked as exercising the most efficacious action upon vegetation—the ammoniacal salts, the nitrates of potassa and soda—and thos of this sand mixed with phosphates. To give an ide of it, it will be sufficient for us to say that the ma which languished and did not come into ear in the p sand, vegetated on the contrary, and fructified in th same sand, mixed with phosphate of lime, and still better in this sand, to which had been added either bone black or phosphate of lime, silicate of potassa, and a certain quantity of organic matter. The peas furnished results quite as palpable. Their vegetation, which was feeble and imperfect in the pure sand, and in the same sand to which was added a certain quantity of nitrates, or of ammoniacal salts, was on the other hand vigorous in sand to which was added phosphate of lime, pure or mingled with carbon; in this the plant flourished and produced seed.

The action of the phosphates was particularly remarkable on the gramineæ, when they were accompanied by silicate of potassa. With the kidney bean these differences which we have just set forth did not take place, as has already been established by Mr. Boussingault; the vegetation of this legume is nearly as vigorous in pure sand as in sand to which any substance whatever has been added; it is therefore an limentary plant which may be cultivated without eat exhaustion of the soil. To recapitulate, it seems us established that the most indispensable agents to etation are the phosphates, the carbonate of lime, nd silicate of potassa. This conclusion, at first sight, seems not to agree with that which various experimenters, and we ourselves, have already published.

Some chemists, in fact, have advanced that the ammoniacal salts are the most powerful agents in vegetation; others have attributed a still greater power to the nitrates, through their transformation, in determinate circumstances, into ammoniacal salt. But if the action of these bodies is incontestable in certain cases, it has not been demonstrated that it always takes place. Too frequently there has been an omission in noting the effect of such or such an agent, and particularly in ascertaining whether it should be attributed to a *direct* or *indirect* action. Because under a variety of circumstances the ammoniacal salts have produced remarkable effects (and in relation to this the numerous and important publications of Mr. Schattenmann may be consulted), without other demonstrative proof than elementary analysis, the principle has been laid down that ammonia acts directly on the plant by the nitrogen which it furnishes to it; but if such were the case, the ammoniacal salts would everywhere produce identical and incontestable effects. Now, if it is otherwise, it is more probable that the action of these salts is only indirect. We will endeavor to elucidate the reason of this.

Whichever ammoniacal salt, muriate, sulphate, or acetate, we pour at the foot of a plant, we remark, after a few days, on the surface of the soil, and on the very spot which has been watered, a white crust, presenting all the physical and chemical characters of chalk—carbonate of lime.

If chalk is found to be of the number of products of the action of an ammoniacal salt upon the vegetable soil, the ammonia must momentarily have been in the state of a carbonate; but to recognize even the momentary formation of this carbonate is to admit a secondary and *consecutive* reaction, for we know that the carbonate of ammonia cannot be in contact with the salts of potassa or soda — sulphates, muriates, nitrates—without decomposing them, and giving birth to an ammoniacal salt, and to a corresponding quantity of carbonate of potassa or of soda.* And who would doubt the energy of these last, either in agriculture—now that we know the efficacy of ashes employed in reasonable quantity—or in theory, since the labors of Dulong have unveiled the potent action of the alkaline carbonates on the insoluble salts?

This formation of alkaline carbonates being admitted, we can conceive that phosphates, insoluble silicates, now absorbable by plants, may be disaggregated by these carbonates, and rendered soluble, either directly or indirectly, by carbonic acid, or by the organic acids developed during the decomposition of animal or vegetable matter, and may become fitted to enter into the stream of the circulation. Thus, in admitting the efficacy of the ammoniacal salts, we explain it in a totally different manner; and, instead of proscribing, as has been done, the carbonate of ammonia, and furnishing the plant with non-volatile ammoniacal salts—sulphate and muriate—we admit the momentary formation of this carbonate, and deduce from it the remarkable effects which observation establishes.

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* Soda has been manufactured on a large scale by this process.

Certain facts also present themselves to give value to this reasoning. Mr. Boussingault, who, on his farm, has several times endeavored to establish the action of the ammoniacal salts upon the cereals, has never arrived at very favorable results in the employment of these two salts. The manner in which we view the action of these ammoniacal salts may explain the fact: the waters of Pechelbronn being rich in phosphates, the soil should be so likewise, and, consequently, as the plants there naturally meet with the quantity of phosphates of which they stand in need, the ammoniacal salts are without appreciable effect upon them. As for the nitrates of potassa and soda, if it is incontestable that they are transformed into ammonia by the action which organic matter exercises upon them, it is not the less so that their base passes into the state of a carbonate. They should, then, exercise a doubly energetic action, first, by the indirect effect of the carbonate ammonia, which excites the formation of the carbonate of soda or carbonate of potassa, then by the direct effect of the carbonate which comes from their base.

Thus, then, compelled by our experiments to contest the direct action of the ammoniacal salts, and of the nitrates which has been so much vaunted, we admit their indirect action in certain soils.

In examining the structure of organized beings, we soon find that their tissue is nothing more than an agglomeration of cells of complex nature; for it is incontestable that parallel with the organic cell there is formed an inorganic one which serves for the consolidation of the former. If any doubt could exist as to this, one need only have recourse to experiments, and subject to incineration a leaf, a vine twig, a bone, etc. The organic matter having disappeared, the exact image of the organ remains. Now, we should not be astonished at finding among the number of the constituent principles of these ashes, carbonate and phosphate of lime; for besides the property which these saline compounds enjoy of being able to enter into solution in water, by the help of the weakest acids, and of thus becoming transportable by the sap of vegetables, and the blood of animals, through the most delicate vessels to every part of the organs, there to become insoluble by the intervention of a base; they further offer the quite special character of not being subjected to *the ordinary laws of displacement* which the other saline compounds experience. Thus, if we treat a sulphate—soluble or insoluble—with a powerful base, this base appropriates the sulphuric acid, and sets the oxide at liberty. Now a similar salt could not participate in the formation of the osseous system of animals, since the base which would contribute to precipitate it, would effect its complete decomposition, and would thus disorganize the cell. On the contrary, with the phosphates and carbonates, the former particularly, the most powerful base never completely removing from a phosphate its phosphoric acid, its action is always limited to the formation of an *insoluble basic phosphate*, and this is precisely the reason why the phosphate of lime has so large a share in the formation of bone. Rendered soluble by carbonic acid, and by the acids of the digestive apparatus, it dissolves, enters into the stream of the circulation, then by the influence of the alkaline secretions, it returns to the state of an insoluble basic compound, indecomposable, while the functions are in a normal condition. If the carbonate of lime is susceptible of being dissolved, and of being precipitated afresh under the same conditions with the phosphates, we will not be wrong in saying that its stability, or the resistance which it opposes, is due to another cause. The carbonates are subjected to the ordinary laws of displacement, but as the carbonate of lime is not decomposed, except by the most concentrated caustic alkalies, the result is, that once lodged in a cell, it cannot be removed from it by the feeble base which provoked its deposit.

Besides the part which they may take in the formation of cells, these two compounds have still other offices to perform, which are to saturate the acids which are developed during the vital functions of beings, and to excite by their presence modifications in the spontaneous decompositions which are observed.

If by reason of the facility with which the phosphate and carbonate of lime become soluble and capable of circulating in the vessels, to be there afterward rendered in some sort indefinitely insoluble, we have been able to comprehend without difficulty all the importance of the functions of these two agents, we must avow that it has been difficult for us to account for the part played by the *silica* which is found in such large quantity in certain plants. Nothing is more simple than to represent to one's-self silica in solution; feldspathic formations are incessantly broken down, effloresce and are decomposed to give rise on the one hand to *clays*, on the other to silicates with a base of potassa or soda, which remain in solution. Here then is this material in the state in which it is susceptible of being transported by water in the vessels of organized beings; but how is it there set at liberty? Up to the present time chemists have accorded to acids alone the power of decomposing the silicates; but to admit such a principle is to reduce one's-self at the same time to the impossibility of explaining the liberation of silica, and to consecrate the most enormous of contradictions. The phosphate of bones has evidently been deposited under the influence of an alkali; since it is a salt with an excess of base. That which is found in the framework of vegetables is deposited there under the same conditions, with this sole difference, that most frequently the deposit is determined by a slow and secondary action of the carbonate of lime. If then, in one and the other case, we cannot conceive of the deposit, except by the intervention of a basic body, how can we explain the part which the silica plays, concurrently with the phosphate and carbonate of lime, in the formation of cells? We have been fortunate enough to find for this problem a solution, which is also the solution of a long-mooted important question, viz., what part does sea-salt perform in agriculture.

What influence does this salt exercise in agriculture, or what is its action upon vegetation? This is a question which has long been under debate, and one of which the solution is still looked for. There is no doubt that in presence of carbonate of ammonia, sea-salt is able to furnish carbonate of soda; we may therefore, from this point of view, already represent it to ourselves as the *source* of a powerful alkali; but this action is but secondary in connection with the mysterious and important part which we have recognized in it. Sea-salt, in fact, in opposition to all theoretical calculation, is no sooner brought into contact with silicate of potassa—soluble glass of Fuchs—than the silica is displaced; if, however, this displacement occurs in presence of a large quantity of water, the silica remains in solution, and by spontaneous evaporation appears in the state of a transparent jelly; if, on the contrary, it is effected in presence of a large quantity of salt, the silica is precipitated in a pulverulent and opaque form, possessing all the characters of those deposits which are often met with in the neighborhood of banks of saliferous formations. Thus is explained the efficacious and direct action which sea-salt, employed in proper proportion, always exercises in the culture of plants which require silica for the formation of their framework—(the gramineæ, for example).

Now that we have, as we think, demonstrated in an incontestable manner the efficacy of the phosphates, carbonates, and silicates, and have through the peculiar properties enjoyed by them, given a sufficient explanation of the part played by these bodies, let us return to our subject.

Our first essays were directed, as we have said, to subjects of a vigorous vegetation. The vine stocks of the experiment having already been developed to a certain point, the potassic salts, for that very reason, exercised upon them a less energetic action; moreover, these salts not being very soluble, reached the roots of the plants too tardily to permit us to appreciate their entire action.

On repeating the same experiments upon young vine stocks, and employing a stronger dose of the potassic salt, we observed, without astonishment, that the vegetation, far from taking on a more rapid development, lost, on the contrary, so much of its energy that the subjects became stunted. The excess of the potassic salts here exercised the action of sea-salt upon those plants which vegetate accidentally in saliferous soils! It is known that the development of such plants is so reduced, that some botanists have made distinct species of them. While reflecting upon these effects, we were struck with the idea of dividing the culture of the vine into two parts; of seeking first to give to the wood, as well by particular care as by the intervention of the phosphate of lime, all the development of which it is susceptible, then to act solely with a view to determine the fructification. Thus have we arrived at the plan of substituting for the ordinary culture of the vine, which we may call *the natural culture*, a culture which is *completely artificial.*

To obtain all the possible development of the wood, we set various vine stocks in trenches, at the bottom of which we had introduced about one kilogramme per square metre* of a compost formed,

1. Of coarsely pulverized bones (bone dust of commerce).
2. Of clippings of leather or fragments of horn.

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* Two pounds, avoirdupois, to the square yard, constitute the same proportion as that of the text.—*Translator.*

We covered the whole of this with good stable manure, mingled with earth. Three vine shoots, *a b c*, treated after this manner in the month of March, 1847, furnished us, viz.:

a. Isabella Vine, of Virginia, one cane 23 feet 10 inches long, and $\frac{78}{100}$ inch in diameter.

b. White Chasselas, two canes, One of 19 feet 6 inches long, the other of 18 feet 1 $\frac{7}{10}$ inch long, $\frac{51}{100}$ inch diameter.

c. Rosy Chasselas, two canes, One of 14 feet 6 inches long, the other of 14 feet 2 inches long, $\frac{63}{100}$ inch diameter.

In the spring of this year, three young rooted vines, *d e f*, subjected to a similar treatment, gave us, viz.:

d. White Muscat, one cane of 21 feet 7 $\frac{8}{10}$ inches long,
e. Gray Tokay, one cane of 21 feet 11 $\frac{78}{100}$ inches long, $\frac{43}{100}$ inch diameter.

f. Gray Muscat, two canes, One 14 feet 6 $\frac{4}{10}$ inches long, the other 14 feet 6 inches long, $\frac{47}{100}$ inch diameter.

Having at the same time covered the roots of the three vine stocks, *a b c*, with a certain quantity of silicate of potassa (the soluble glass of Fuchs), we obtained the following results:

On the stock *a*, (Isabella), 48 shoots put forth from the axils, and each of these bore three or four bunches.

On the stock *b* were developed 23 shoots, having at the base a diameter of $\frac{59}{100}$ of an inch. Upon each of these shoots there were, on an average, three bunches of grapes. The stock *c* presented 80 shoots, each bearing, on an average, three grapes. The diameter of these shoots gives a mean of $\frac{43}{100}$ of an inch; one of them, that which terminated the wood of the last year, attained a length of 10 feet 9 $\frac{92}{100}$ inches. From all the comparative trials which we have made, we have concluded that we must guard ourselves against confounding the development of the wood or cellulose, with that of the germ, seeing that in many cases the predominance of the one takes place only at the expense of the other. After all we do but confirm a fact already known, for we are generally aware that a tree which puts forth very vigorous shoots rarely bears fruit; and, on the contrary, that one in which the cellular development is artificially retarded is commonly loaded with it.

CULTURE.

It is not our intention to develop the various systems followed in cultivating the vine, that we may compare them with that which we have just proposed; a labor of this sort would here be useless. The sole fact which it concerns us to establish is, that each vine stock must extract from the soil in which it is planted, the elements necessary to the development of its cells and germ, unless we furnish directly to its roots the quantity and quality of manures which suit it. In the former case, these elements are furnished to it by the successive decompositions which are effected in the bosom of the earth. Now, as the potassic salts, indispensable to fructification, proceed most frequently from the alterations which the feldspathic rocks suffer, and as these break down only through the concurrence of heat and humidity, the success of a harvest, until now, all other circumstances being equal, has depended, in great degree, upon atmospheric influences. Thus, if a vine stock requires ten parts of potassa that it may bear fruit; and if the action of heat and rain upon the rocks and soil, in a decomposing state, can furnish but five parts, the crop fails.

This danger is warded off by our system of culture, in which the vine will constantly have proper nourishment; but it must be understood, that in guaranteeing to the vinedresser, who has recourse to it, the quantity of the product, we do not pretend to give him any assurance as to the quality, this latter being always dependent upon the temperature.

The trouble of treating each vine stock separately, would be avoided by establishing a trench of sufficient dimensions, in which should be laid down a certain number of shoots, to which should first be given all the manure indispensable to their development; then, at the end of one or two years, the quantity of potassic salts recognized as necessary to the formation of the fruit.

The various trials which we made upon a small scale having answered our expectations, and having, up to the latest moment, controlled each the others, there does not exist in our mind the smallest doubt as to the value of our experiments.

It remains only to establish by trials undertaken upon a scale of a certain magnitude, whether the wine proceeding from a grape thus obtained has all the qualities of another wine, and whether all the varieties of the vine lend themselves advantageously to a system of culture, the details of which we shall now give.

To put the subject in a clearer light, let us suppose that on a slope sixty-five yards long by thirteen broad we desire to cultivate the vine. At the lower part we dig a trench one yard three inches wide, by about eighteen inches deep (see plate I.), according to the nature of the soil, the exposure, and the climate.

The trench should be deeper if the soil is dry and sandy, or if the climate is hot; if, on the contrary, *the soil is heavy*, the climate humid and cold, it should be shallower, that the sun's rays may exercise a greater action.

In this trench we lay down (*plant by layering*) old vine shoots, or in default of these, we plant young vine stocks, to which has previously been given the culture requisite for successful layering. In either case it will be proper beforehand to prune the vine destined for layering the following year, so as not to allow the putting forth of more than two, or at most three buds, that the sap may be accumulated upon these canes, which by increasing their strength will cause them to attain a length of eight, or even ten feet, if possible. This length is indispensable, in order that upon the stock a *number of radicles may be developed in proportion to the respiratory organs of the stem* (the branches, leaves, and fruit).

In treating, after this fashion, either old or young vine stocks, we arrange matters so as to obtain throughout the whole extent of the trench sixty or seventy layers, each one of which is allowed to retain two buds only. Of these seventy layers, forty-eight are directed by fours around stakes $E\ \overset{\prime}{E}\ \overset{\prime\prime}{E}\ \overset{\prime\prime\prime}{E}$, (plate I.), forty or forty-five inches set apart, which are destined to support the trellis; as for the others, they rise up on the opposite side of the trench, and are reserved to replace those which may die. In laying down the shoots, an indispensable precaution to be taken consists in removing with the pruning knife, those buds which may be found upon the stem to be buried, and to make also, upon the articulation a slight incision, which, by impeding the flow of sap, produces upon the spot *a swelling*, and eventually a proper development of radicles. By neglecting this precaution we deprive several articulations of roots. If some vine-dressers understand the advantage that there is in not layering the vine until the moment at which the buds have acquired a certain development—a half to three-fourths of an inch—it is because, without thinking of it, they then naturally make at each articulation a wound, while detaching these buds with the thumb.

The buds having been removed, we place upon the shoots laid in the trench, about two and a half, or two and three-fourths inches in depth, of a soil with which has previously been mingled, for each square yard of trench surface.

Six pounds of bone dust, three pounds of clippings of skins, leather (shoemaker's and tanner's refuse), shavings of horns, hoofs, blood, etc., one pound of plaster; or one hundred and twenty pounds of this mixture for a trench of twelve yards long. The proportions indicated may be increased without inconvenience, since this compost acts slowly.

When the soil is tenacious or clayey, it is beneficial to mix with it, either sand or marl, or finely powdered charcoal, that the soil may be rendered mobile, and that the development of the radicles may be favored. To this end, we may also add to this stratum of phosphated compost a certain quantity of cow or horse dung. We have made experiments which prove that if we layer a shoot, at a certain depth, so as to cause it to describe a wide letter U, the roots cannot develop themselves at a greater depth than from six to ten inches: below this either no roots at all are found, or they are rudimentary.

Though these data refer to the circumstances under which we operated, and though the surrounding temperature, and the nature of the soil may modify them, it nevertheless remains established that at the moment when the roots strike, the wood should be covered with but a moderate quantity of soil, that they may be more accessible to solar heat. Now, if heat is necessary, we can understand that the manure employed contributes, by its decomposition, not a little to hasten the development of the roots, and consequently that of the vine.

The sap being in motion, in order to assure the success of this new method of culture, we must, when the two shoots, which have been procured from each layer, have attained a length of four inches, pinch off the weaker, so that all the sap may be directed to the more vigorous one, which then takes a rapid development, and requires constant care. Thus, for example, a plantation of this kind should be visited every eight days, the young shoots should be tied to supports, precautions being taken that the cells, which offer but a slight resistance, may not be lacerated, that the growth may not be hindered, and that we should not forget to suppress each bud growing at the axil of a leaf; then, if we have been able to layer, at least two yards six inches of shoots, and if at each articulation roots have been developed, we are sure of obtaining from the very first year stems at least sixteen feet long.

If some shoots seem unthrifty, we must not hesitate to relayer them, never leaving more than two buds to each layer.

When we have managed to develop canes as vigorous as those of which we have given the diameter, we proceed to the formation of the trellis. To this end, we plant, at a distance of two yards, twenty-five and a half inches, and at a depth of one yard three inches, three posts, E P R, $E' P' R'$, $E'' P'' R''$, two yards six inches long, by a cross section of four by two and three-fourths inches. On the length of one yard three inches, which remains above the soil, we construct three stages.

A first stage, at fifteen and a half inches from the earth, formed by two slats L S, two yards, twenty-five and a half inches long, by one and a tenth inch thick, and two and three-fourths to three and nine-tenths inches wide, pierced with holes throughout its whole length; these slats are fastened by the two extremities to the posts E P R, and at the middle, to the pickets *o g*, which are one inch and ninety-five hundredths square, by thirty-one inches long, fifteen and a half inches of which are buried. *A second stage*, at eleven and seven-tenths inches above the first, composed of two strong iron wires, fixed by one of their ends to the two sides *m m*, of the post E, and by the other to the points *t t* of the two sides of the post R, after having been stretched, and then turned around a nail planted in the intermediate post P.

A third stage, at twenty-three and a half inches above the first, and consequently at one metre above the soil; arranged exactly like the preceding, that is to say, in such a manner that the wires shall pass from the points *n n* to go to the points *u u*.

Of the four layers, F G H I, F' G' H' I', etc., issuing at the base of the posts E E' E'', we choose, in the spring, the two shortest; prune them, bend them cautiously to the two sides of the slats L S,—lower stage—and at the same time we fasten them by osier ties

1 1 1, which are passed through the holes made in these slats, parallel to one another, the articulations being caused to alternate. This arrangement, while it affords greater space to the shoots, gives to the trellis the aspect of a continued series of vines trimmed crown fashion.

The canes of the other two remaining stocks are led along the wires of the intermediate stage *m m*, *t t*, that is to say, upon each of the two sides of the posts E P R. They are fixed to the wires by means of osier ties 1 1 1, precaution being also here taken to cause the articulations to alternate. If a slat is employed for the lower stage, it is solely with a view more easily to stretch the wires, to draw more forcibly upon them, without fearing that the tops of the posts should approximate.

When the canes, which constitute the trellis, are sufficiently developed, we furnish the roots with the potassic salts which are to determine the fructification. To this end, we spread above the trench, at a distance of from two and three-fourths to three inches from *the buried vines*, four pounds, avoirdupois, per square superficial yard, of a mixture formed of eight pounds (av.) of silicate of potassa, two pounds (av.) of the double phosphate of potassa and lime. We then fill the trench level with the surface, and the roots have, for a long time, the quantity of potassa which is necessary for them; to prevent its exhaustion, it is good to deposit each year, at the foot of the vine stocks, a certain quantity of the marc of the grape. This marc, or residuum from the press, furnishing by incineration two and a half per cent. of carbonate of potassa, restores annually to the trench a considerable quantity of the potassa which it had carried off.

We may, in the same way, usefully employ the residue of the ashes from which ley has been made, which also contains potassa, and certain plants rich in potassic salts.

CARE TO BE GIVEN TO THE TRELLIS.

PRUNING.

PRUNING is one of the important operations in the culture of the vine. The method which we follow is that called Thomery's. We will explain it in a few words, the figures which we give—Plate II—sparing us the trouble of entering into long details relating to it.

The first year, we prune the trained wood (fig. 1.), by removing all the tendrils 00,00; each bud gives, during the growth of the year, a new cane (fig. 2), which bears at its lower part, a bud commonly called *false bud;* after this, throughout its whole length, a series of buds opposite to one another.

The second year, the vine is trimmed from *a* to *b*, from *c* to *d*, and from *e* to *f*, so as to preserve none but the true and false buds, which in turn, become each a cane (fig. 3), and as it is to our interest to preserve the shoots on a level with their respective stages, the pruning of the third year is directed:

1st. Upon the wood of the second year, from a' to b' from c to d, and from e' to f'.

2d. Upon that of the third year, from a'' to b'', from c'' to d'', from e'' to f''.

Here again, the true and false buds each give a cane; So that on the fourth year the third pruning is directed upon the wood of the third year, in the direction of the line a'', care being taken not to reach the young wood, which is in juxta position with the old and from c'' to d'', and from e'' to f''; then, still preserving the two buds, we trim the young wood from a''' to b''', from c''' to d''', and from e''' to f'''.

The young wood should be cut at a distance of six-tenths of an inch from the bud; and when the old is cut, we must be careful not to attack the principal stem, as one is often tempted to do for the sake of appearance. It is better to leave a small end, which will dry up, and may be cut away the following year without producing a wound.

REMOVAL OF BUDS

When, toward the middle of the month of May, or a little later, the shoots of the year have acquired a certain strength, those often surrounding the false bud, and in particular those which grow at the axil of the leaves, are to be removed, that the buds of the succeeding year may be better nourished. We then pinch off the extremity of each cane, to arrest the ascending flow of the sap, and to keep it in the lower regions, thus strengthening the wood which is to bear fruit. This operation deserves the greater attention, since its effects are felt less on the crop of the year than on that of the year following.

LIFTING.

When the vine is leafless, each cane is lifted, and after having again removed buds, if that is necessary, we attach, by means of a tie of straw or rush (plate I.) 3 3 3, etc., viz., the shoots of the lower stage, partly to the stock, partly to the wire of the intermediate stage *m t:* and the shoots of the second stage, to the wire of the upper stage *n u.* This arrangement is figured in plate I.; but we see the right side alone. The cross section, following the line x y (plate I., fig. 4), exhibits both sides at once.

After the first year, particularly after the second, the effect of the potassic salts shows itself in so marked a manner upon the vine, that the growth of wood is retarded, to such a degree that we may blend into one, the two operations just described; that is to say, after pruning, we may abandon the training until the flowering, and may remove buds, at the same time that we lift the shoots of the year. We have thus operated for two years.

In the vineyard, the dimensions of which have been given above—thirteen yards in breadth, by sixty-five in length—we may dig, at a distance of five yards fifteen inches from each other, ten trenches parallel to that of which we have just spoken, and we may establish as many trellises, separated only by the trenches. These trenches do not remain unfurnished; elevating the shoots which the layers of reserve, properly spaced off, have necessarily furnished, we then bend them in the form of a distaff around the supports $J\ J'\ J''$.

Now that we have set forth the operations of the culture, let us indicate the means of procuring the composts in question. The part played by tendons, horn, hoofs, and dried blood, etc., explains the interest which there is in carefully collecting them; but as these materials, now procurable at a very moderate price, might become too dear, it is of importance to seek the means of always having at our disposition large quantities of phosphates. This would be accomplished by collecting urine, and turning it into a pit constructed of hydraulic mortar, and furnished internally with plaster—sulphate of lime. This, attacked by the salts held in solution by the urine, yields an abundant deposit of phosphate and carbonate of lime; the ammonia passes into the state of a sulphate, and this latter, separated by decantation, might be spread with advantage on certain soils. The deposit drained, might be employed in establishing trenches, for the development of the cellular tissue of the vine.

As for the potassic salts, we must renounce the use of those which are met with in commerce, and which are very soluble. Their action on the vine is such, that they can be employed, only when mingled with eminently absorbent bodies, such as bone-black, which yields them up slowly to the roots. It is indispensable to employ none but salts which give up gradually the potassa to the vine. The most advantageous, in this respect, is the soluble glass (silicate of potassa), which is obtained commonly by fusing fifteen parts of quartz (sand), with ten parts of the potassa of commerce and two of charcoal. In this particular case, it is better to increase the proportion of potassa, to render the glass more attackable. It is, however, more economical directly to employ the saltern. (This is the residuum, after the evaporation of the lixivium from ashes, which is calcined in furnaces to furnish the potash of commerce.)

We propose fifteen parts of sand for thirty-five of the saltern. The mass thus obtained undergoes deliquescence very readily.

We may also, when in the vicinity of feldspathic rocks with a base of potassa, roast them with a certain quantity of this base in a carbonated state, fifteen to twenty per cent., with a view of accelerating their decomposition.

The phosphates, or rather the double pyrophosphate of lime and potassa, may be procured at small expense. To this end we treat twenty-four pounds of bones calcined at a white heat, pulverised and diluted with a quantity of water, sufficient to make a very thin pulp, with eighteen pounds of sulphuric acid, which we pour gradually on the calcined bones, stirring continually. Sulphate of lime* and a biphosphate of the same base are produced; then, after having added water to make it once more into a pulp, we leave it at rest for two or three days, treat it with hot water, and strain through a cloth, upon which the sulphate of lime remains; in the liquid is found phosphoric acid and phosphate of

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* As this salt may be employed successfully in the first phase of the culture of the vine, the labor of washing it carefully may be dispensed with, and consequently we are not exposed to the loss of the phosphoric acid.

1st. A considerable reduction in the expenses of culture.

2d. The possibility of usefully employing sterile soils, even rocks.

3d. If the soil is fertile, of devoting, at least, the half of it, to the cultivation of alimentary plants, while obtaining the same crop. Surely a very precious advantage, since, with the least expense, and without increase of labor, the poor vinedresser, obliged now to barter every year the product of his toil, frequently at the very time of vintage, for the aliments necessary for the existence of himself and family, would thus find the means of procuring these, while preserving his crop of grapes; and the rich, that of coming to the assistance of unfortunate laborers without sacrificing anything of their revenues